



# ATIS NEWS

Volume 3, Issue 3  
Winter 1999/2000

## ADOT GIS Day A Success!

The first annual ADOT GIS Day Open House was held on November 19, 1999. The event showcased ADOT's use of Geographic Information Systems (GIS) Technology through static map displays and user demonstrations.

The opening remarks were given by Gene Trobia, the Arizona State Cartographer. Mr. Trobia spoke about the future of GIS technology saying that in five years he expects to see GIS work done with standard computer equipment, merging the technology with computerized drafting and photogrammetry equipment. He noted that the rapid pace of technology and increased applications for GIS will lead the way towards simplifying GIS. GIS standards are already being implemented to allow the universal use of GIS technology.

Tony Gonzales, ADOT's GIS Project Leader, gave an overview of GIS in ADOT. Employees who are connected to the ADOT Local Area Network (LAN) have access to download maps and GIS data from the dedicated GIS server. Maps and data available include airports, biotic communities, ADOT engineering districts, land use, and more. Additionally, ADOT users can access the electronic versions of the State Highway Log and State Photo Log from the server.

If you're a frequent reader of the ATIS News you already know that many areas within ADOT are taking advantage of GIS technology. Ed Green and Mike Dennis from ADOT's Environmental Planning section demonstrated their use of GIS. Environmental Planning uses hand-held GPS units and aerial photography for evaluating corridor study areas. For example, Mike Dennis explained how a hand-held GPS unit and aerial photos

were used to place small flags along the proposed alignment for widening SR 260 between Payson and Heber. The flags served as a visual guide to the US Forest Service and other interested environmental groups who inspected the site before final plans were made for the project. Using the GPS technology rather than a survey crew reduced the time by about two weeks.

Justin White, ADOT's Natural Resources Manager in northern Arizona, demonstrated how his section is using GIS technology for controlling noxious weeds through controlled burns and herbicides. The GIS aids in the determination of herbicides to use based on the soil type.

Other demonstrations at the Open House included the ADOT Accident Database, GIS applications on the Internet, ArcExplorer (a free GIS viewer software), and QuadsUSA (a USGS Quadrangle map viewer).

Outside the demonstration area was the static map display with about 30 maps available for viewing. The maps on display were not limited to just ADOT applications. Along with the ADOT highway map, Airport map, and accident locations map were maps displaying the following data: City of Phoenix crime statistics, DES population demographics, land use database, urban planning, American Indian Reservation boundaries and more. Many of these maps are also available on our website in PDF and graphic formats at <http://map.azfms.com>.

For more information on GIS in ADOT, contact Tony Gonzales 602-712-7818 (email [tgonzales@dot.state.az.us](mailto:tgonzales@dot.state.az.us)) or Jami Garrison 602-71208958 ([jgarrison@dot.state.az.us](mailto:jgarrison@dot.state.az.us)). ☎

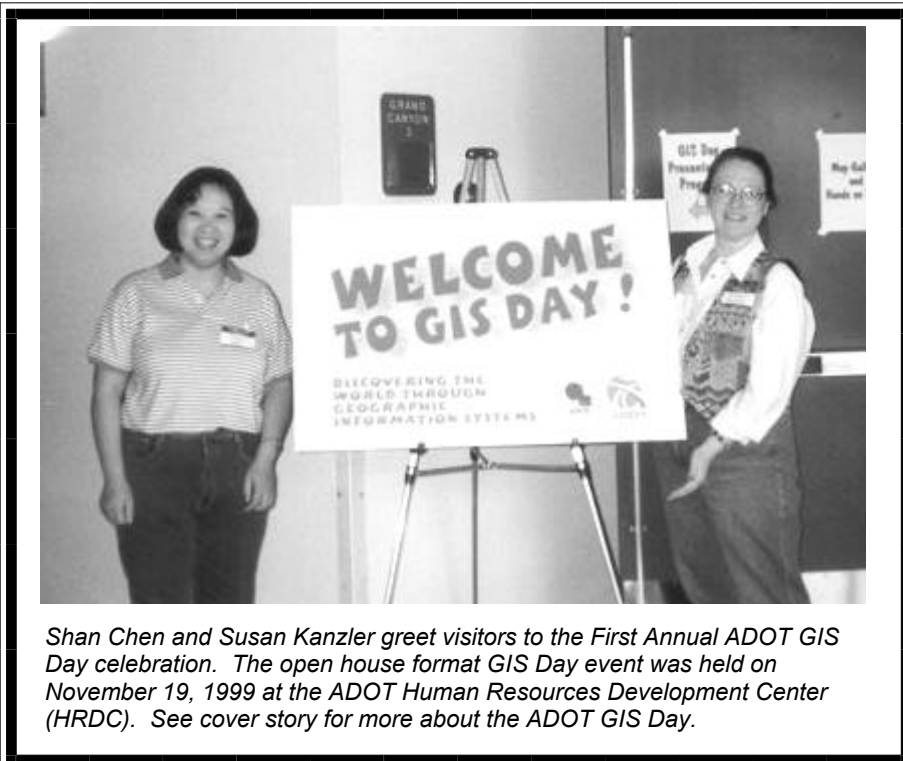
### Inside this issue:

User Group News	2
Real World GIS	3
New Population Estimates	4
GIS Higher Learning	4
Training News	5
Nationwide Differential GPS	6

### Upcoming Events

- GIS User Group meeting  
January 19, 2000 in  
Phoenix, Arizona
- GIS 2000  
March 13-16, 2000  
Toronto, Ontario
- GIS-T 2000  
March 27-29, 2000  
Minneapolis, MN
- 96th Annual Meeting of the  
Association of American  
Geographers  
April 4-8, 2000  
Pittsburgh, Pennsylvania
- 29th Annual  
ESRI User Conference  
June 26-30, 2000 in  
San Diego, California

(see page 3 for details)

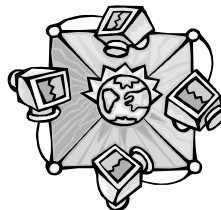


## Worthy Websites

### The Federal Aviation Administration - Global Positioning Satellite Product Team

<http://gps.faa.gov>

The Global Positioning System Product Team (GPS PT) web site is designed to inform the aviation community and the public on the FAA's satellite navigation programs and the efforts of the GPS PT related to the development and implementation of these technologies. The site is designed for both the novice and the experienced GPS enthusiast and will provide updates on the GPS PT's activities, programs, international activities, as well as documents and briefings on GPS and satellite navigation.



### US Coast Guard Navigation Center (NAVCEN)

<http://www.navcen.uscg.mil>

The U.S. Coast Guard Navigation Center (NAVCEN) provides quality navigation services that promote safe transportation, support the commerce of the United States, and directly benefit world-wide international trade. Here you will find detailed information about the Nationwide Differential GPS initiative.

### US Naval Observatory Clock—What Time Is It?

<http://tycho.usno.navy.mil/>

The Official Source of Time for the Department of Defense and the Standard of Time for the United States "The Department of the Navy serves as the country's official timekeeper, with the Master Clock facility at the Washington Naval Observatory." —National Defense Authorization Act for Fiscal Years 1992 and 1993.

## GIS User Group News

### Meeting Notes

Have you attended a GIS User Group meeting yet? Our next meeting is scheduled for 1:00 pm, January 19, 2000, at the ADOT Traffic Operations Center, 2320 W Durango St, Phoenix. The user presentation and technical demonstration has not yet been determined for our January meeting so you need to keep an eye on the website or sign up to the listserv to keep informed. The website address is <http://map.azfms.com/usergroup>.

If you have questions about User Group activities, please contact Jami at (602) 712-8958 or [jgarrison@dot.state.az.us](mailto:jgarrison@dot.state.az.us).

### GIS Day Thanks!

Tony and I would like to extend a big thank you to those of you who helped make the first ADOT GIS Day a success. Those of you who attended, we hope you gained some useful information. And special thanks to those of you who helped set up: **Susan Kanzler, Shan Chen, Wayne Rich, Ed Green, Mike Dennis, and Joe Breyer**. And also thanks to our speakers, **Gene Trobia, Justin White, Ed Green, Mike Dennis, and Joe Breyer**.  
-Tony Gonzales and Jami Garrison

### ESRI Workshop Recap

A special thanks to ESRI and ASU's GIS User Group for inviting us to the ESRI ArcShop (workshop) held on December 8 at ASU. The morning included an overview of Arc/Info 8 and ArcIMS, the newest ESRI internet mapping application.

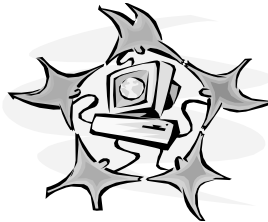
After lunch, the ESRI staff members hosted two separate hands-on activities. The Arc/Info 8 "Dr Office" had about a dozen or so people in attendance. Here attendees were able to sit down with an Arc/Info expert and learn first hand how the newest release of ESRI's flagship software will improve their GIS work.

The ArcIMS workshop was the most popular. ESRI had brought with them about 20 laptops, loaded with ESRI software and networked together. For those lucky enough to get a desk with a laptop on it, they were able to try out, first hand the new ArcIMS product. Check out ESRI's website at <http://www.esri.com> for upcoming ArcShops in your area.

## Real World GIS

### ADOT Uses GIS to Produce Annual Status & Condition Report

The ADOT Advanced Planning Team first produced its *Status and Condition of the Arizona Highway System* report in 1998. In December, they released the 1999 report.



The intent behind the report is to present transportation planning information in a format that is useful for both a professional and lay audience. In the past, reports of this type consisted of huge tables of data where one had to read thru rows and columns of numbers. There were also some graphs and charts to aid in the interpretation of the data as well as a few maps for reference purposes.

The 1998 and 1999 reports were prepared using ArcView GIS to generate maps using ADOT's extensive databases of highway data. The Arizona state highway system has 6,619 route miles and there are 3,945 bridges on the system. The data that are used

to develop various performance measures are collected throughout the year and stored in individual databases. These databases are then integrated into the Highway Performance Monitoring System (HPMS) database, which, in turn, is then incorporated into the ADOT GIS.

The GIS-developed maps included in the report are:

- the State Highway System
- Bicycle Suitability Routes
- 1997 Average Annual Daily Traffic (AADT) volumes
- Percent of Commercial Vehicles in the traffic stream
- Level of Service (LOS)
- Present Serviceability Rating (PSR)
- Bridge Sufficiency Rating (BSR)
- Functional Classification
- Level of Development (LOD)

All of the maps depict the entire state. However the LOD, LOS, PSR and BSR maps also include individual county detail maps for closer examination of the data.

Since the 1999 report is the second annual report, it includes charts and maps depicting the change in condition for level of service and present serviceability rating from the 1998 report.

The *Status and Condition of the Arizona Highway System* report is available on ADOT Transportation Planning Division's website at <http://map.azfms.com>. Limited quantities are available in print, but the online version is available as downloadable and printable Adobe PDF files.

For more information about the report, contact Joe Flaherty at 602-712-7172 (email [jflaherty@dot.state.az.us](mailto:jflaherty@dot.state.az.us)) or Lynn Sugiyama at 602-712-6883 (email [lsugiyama@dot.state.az.us](mailto:lsugiyama@dot.state.az.us)). ☐

## UPCOMING CONFERENCES AND EVENTS

### GIS User Group Meeting

Mark your calendar now to attend the next User Group meeting on January 19, 2000 at 1:00 p.m. at the ADOT Traffic Operations Center, 2302 West Durango St, Phoenix — in the basement conference room. Everyone is invited to attend. Check our website at <http://map.azfms.com/usergroup/> for more information or contact Jami at (602) 712-8958; email [Jgarrison@dot.state.az.us](mailto:Jgarrison@dot.state.az.us).

### GIS 2000

GIS 2000 is the 14th Annual Conference on Geographic Information Systems. GIS 2000 provides a more interactive, solution-oriented program with vertically-integrated 'mini-conferences' centered around Canada's largest GIS Trade Show. Major themes of the conference will be Forestry and Natural Resources, Business Geographics, Internet GIS, Geospatial Data, Precision GPS, First Nations, Telco/Utilities and more. The conference will be held March 13 – 16, 2000 at the Metro Toronto Convention Centre, Toronto, Ontario. More information: Matt Ball 303.544.0594, <http://www.gis2000.com>

### GIS-T 2000

The annual GIS for Transportation Symposium is a chance for those interested in the use of GIS for transportation to get together and share experiences, see state-of-the-art software, and learn more about this field. The 2000 event will be held in Minneapolis, Minnesota March 27-29, 2000. Visit <http://www.gis-t.org> for details or call Diane Pierzinski at (916) 654-3379.

### Association of American Geographers

The 96th Annual meeting will be held in Pittsburgh, Pennsylvania on April 4-8, 2000. More information will be released on their website sometime in late January 2000 at <http://www.aag.org/AnnualMeetings/Intro.html>

### ESRI 20th Annual User Conference


Always a must! If you only attend one GIS conference this year, make it the ESRI Annual event! The 2000 conference will be a month earlier than usual, June 26-30, 2000 in San Diego, California. Get more information from the ESRI website at <http://www.esri.com> ☐

## GIS Higher Learning

ESRI has created an online database that they hope to evolve into a comprehensive list of universities and colleges that offer GIS-related course, certificates or degrees. Currently there are about 150 entries, but the database is set up so that individual schools can register their programs online to be listed in the database.

You can search this database to locate GIS programs in your local area or you can locate geography departments or engineering schools that teach GIS. There are a number of ways that the database can be searched.

The database allows a school to indicate which ESRI software products they are teaching with. The fact that a school teaches with ESRI products (or others) does not constitute an endorsement of the product. Some schools teach with a large number of software packages from different vendors. Many universities choose to emphasize the theory and application of geographic information science rather than just the technology. If you're interested in furthering your GIS career or perhaps even starting one, this can be a valuable resource.

The GeoCommunity also has a database listing of universities and colleges offering GIS education. The database is very similar to the one on the ESRI site, except it does not have the added information about whether or not they use ESRI products. The listing here is simply listed by region, and not really searchable like the ESRI listing. Still, it is a good resource and the worth a look. Just be sure to keep in mind that both of these databases, the ESRI and the GeoCommunity, are continually expanding, so be sure to check back for more links and resources to GIS programs. 



ESRI online database:  
<http://gis.esri.com/university/onlinedb.cfm>

The GeoCommunity links:  
<http://www.geocomm.com/links/education>

## ArcInfo 8 Now Shipping!

The latest release of **ArcInfo**, ESRI's flagship software package, is now shipping. ArcInfo is a high-end GIS with capabilities for automation, modification, management, analysis, and display of geographic information. Because of its Open Development Environment, ArcInfo allows users to easily build custom applications and interfaces. Various extensions are available to extend core functionality. ArcInfo adheres to modern software engineering and computing standards and runs on a variety of hardware platforms, including UNIX workstations

as well as Windows NT computers.

A key feature of ArcInfo 8 is that it makes sophisticated GIS more usable. New applications, such as ArcMap and ArcCatalog, accomplish this goal by approaching GIS from a new perspective. While the depth of functionality in ArcInfo is tremendous, new user interfaces and wizards make it easy by presenting users with what they need when they need it.

To learn more about ArcInfo 8, visit the ESRI website at <http://www.esri.com>.

## TPD Acquires Digital Aerial Photography

The ADOT Transportation Planning Division (TPD) has recently acquired digital aerial photography for Maricopa County. Purchased from DigiAir, the photography will soon be available to ADOT users on the LAN/WAN. DigiAir combines hundreds of ortho-rectified color images into a seamless map on a CDROM. The CDROM contains Windows compatible viewing and exporting software that allows users to export the data to many other software programs (i.e. ArcView, AutoCAD, Microstation, Word, Photo-shop, etc).

Users familiar with the USGS QuadMap interface will recognize the viewing inter-

face of DigiAir, as the two are very similar. The viewing software also allows users to:

- plot seamless ortho imagery to any scale in just seconds
- Calculate preliminary measurements
- Overlay TIGER and FEMA Flood Zone data
- Quickly access georeferenced data


For additional information on the DigiAir product at TPD, contact Tony Gonzales at (602) 712-7818 or email [tgonzales@dot.state.az.us](mailto:tgonzales@dot.state.az.us).

## DES Releases New Population Estimates

The Arizona Department of Economic Security (DES) recently released the July 1, 1999 population estimates for Arizona counties and incorporated cities. The population estimates are calculated annually based on housing starts, vacancy rates and group quarters (i.e. prisons, nursing homes, etc) data. Actual counts of the population will be available after the April 2000 decennial census results are available, probably sometime at the end of the year.

According to the July 1, 1999 estimates, Arizona had approximately 4.9 million residents. Phoenix recorded at 1,240,775 residents while Tucson, the state's second-largest city, didn't quite make the half-million mark at 475,450 residents. The Town of Marana recorded the largest percent growth (465%!!) from the 1990 Census, with

Oro Valley (310%), Surprise (267%), San Luis (256%), and Gilbert (246%) rounding out the top 5 in percent growth. The Town of Winkelman actually recorded a loss of 236 (35%) since the 1990 Census. This is undoubtedly due to the flood that wiped out most of this town in the early 90's. Guadalupe and Gila Bend also recorded a drop in population since 1990, however, this could be an estimating or rounding error since the decreases are small.

These figures, plus ranking tables for the state's incorporated places, are available on the DES website in text and Microsoft Excel formats at <http://www.de.state.az.us/links/economic/webpage/page2.html>. You may also call the DES Population Statistics Unit at 602-542-5984 for Arizona population and demographic statistics. 

# Training News

## Introduction to ArcView GIS

This two-day course provides a conceptual overview and hands-on experience using ArcView GIS software. The course teaches basic ArcView GIS functionality and enables participants to quickly take advantage of the software's powerful display and analysis capabilities. The prerequisite to the course is a working knowledge of the windows operating system environment and a willingness to learn!

ADOT provides this ESRI Authorized training four times a year at little or no cost for ADOT employees. Local government employees are also eligible to attend these classes through the Local Technical Assistance Program (LTAP) at a reduced rate. If you are interested in attending please contact Stefanie Karnitz of LTAP at (602) 712-8461. ADOT employees should contact Shari Ligerman of ITD Technical Training at (602) 712-4939.

*Sorry, but we cannot allow any consultants or other private industry employees to enroll in the class. Non-government employees can find a list of Authorized Instructors on ESRI's website at <http://www.esri.com>.*

## ArcView GIS 2000 Course Schedule

April 26-27, 2000  
August 16-17, 2000  
October 18-19, 2000

*\*all classes taught at ADOT Human Resources Development Center (HRDC) in Phoenix at 1130 N 22nd Ave.*

## Advanced ArcView Course

Still no big news or a date set for the Advanced course. We are working with LTAP and ITD to schedule a time for the advanced course. When we get the details worked out (date, time, cost, etc), we will publish it here and announce it on the User Group List Server. To sign up for the GIS User Group List Server, send an email to [majordomo@webimaj.com](mailto:majordomo@webimaj.com), leave the subject blank and the only information in the body of the message should be "subscribe GISUG-L" (don't put the quotes in there).

## Online Tutorials

As promised, we now have a few tutorials available online. These are tutorials that appeared in past issues of the ATIS News. The Available tutorials are:

- Using the ArcView Projector! Extension
- Adding and using an ArcView script to calculate length
- Internet Mapping with the iMapper extension
- Exporting an image in QuadsUSA

You can find these tutorials on our website at:  
<http://map.azfms.com/usergroup/tutorials.html>.

Have ideas for other tutorials? Send your suggestions/comments to Jami at [jgarrison@dot.state.az.us](mailto:jgarrison@dot.state.az.us).

Congratulations to the most recent graduates of ADOT's Introduction to ArcView GIS course!



Samuel Colon  
Daintry Donovan  
Jack Richardson  
Joe Scott  
John Hoang  
David Moy  
Robert A. Christ  
Deann Vink  
Joan Blankenship  
Lisa Kay  
Nancy Ann Crandall  
Philip A. Scandura, Sr.  
David M. Gibson  
Kathy York  
Mark D. Henige  
Peggy Goode  
Sharan Johnson  
Charles J. Ebner

These students attended the two-day *Introduction to ArcView* course on October 20-21, 1999.

If you are interested in attending one of our classes, please contact Stefanie Karnitz of LTAP at (602) 712-8461. ADOT employees should contact Shari Ligerman of ITD Technical Training at (602) 712-4939.

## Nationwide Differential GPS

### What is DGPS?

*Differential GPS (DGPS) is the regular global Positioning System (GPS) with an additional correction (differential) signal added. This correction signal improves the accuracy of the GPS and can be broadcast over any authorized communication channel.*

GPS satellite signals can be received around the world. The existing GPS uses 24 satellites to provide radio signals which allow persons on the ground, in flight, or at sea to determine their location. Until recently, GPS users who wanted to get accurate, differential GPS readings had to pay a subscription fee to a private company or maintain their own base station in order to receive the base station signal used to provide the additional [differential] correction to the standard GPS transmissions.

In 1990 the US Coast Guard established its ground-based differential GPS, covering the coastal areas and navigable waterways. Then, in 1994 a GPS Augmentation study was conducted and recommended that the USDOT expand the Coast Guard's maritime system (the DGPS) to provide continues marine and land coverage for surface users. Following that, in 1997, Federal agencies began planning for a GPS to provide Nationwide coverage. Thus the Nationwide Differential GPS (NDGPS) was born.

Once fully operational, the NDGPS will cover the nation with the most accurate and reliable navigation system that the country has ever had. GPS users, both civilian and government, will have free access to the NDGPS. The NDGPS will augment the existing satellite system with ground-based radio transmitters, known as reference stations. The reference stations will broadcast a signal from a transmitter located at a known fixed location on the ground. Users who receive the ground-based signal in addition to the normal satellite signals will be able to determine their position with an accuracy of 1 to 3 meters (see table). While the existing Coast Guard DGPS provides service near coastal areas and navigable waterways, NDGPS would serve the remaining 55 percent of the continental US and Alaska.

The exciting news is that this will be much more than a navigation system.

Already the portions of the system that are operational are being used for such things as surveying, weather forecasting and precision farming. Additionally, the NDGPS is designed to meet international standards so that eventually, as more countries adopt the standard, it will provide for a seamless international navigation system. And, not just for the sole use of government, the signal is free to any user who has the proper equipment.

The Federal Railroads Administration proposed the development of the NDGPS for use with Positive Train Control. Positive Train Control will serve to prevent rail accidents, save on fuel consumption (by better pacing trains), and increase rail line capacity through closer train spacing.

DOT and Intelligent Transportation Systems (ITS) can utilize NDGPS by combining it with GIS and communication links to create an integrated vehicle safety system. This integrated safety system could:

- ✓ Automatically notify emergency personnel when an air bag is deployed, allowing for faster response to the exact location, thus saving some of the 41,000 people who die on U.S. roads each year.
- ✓ Automatically reroute traffic around an accident, preventing multi-car pile-ups and improving traffic flow.
- ✓ Plot cost effective trips, thus saving both time and fuel.

Additional Federal and State agencies have public safety needs that can be met through utilization of the NDGPS. These include such things as:

- Mapping transportation infrastructure
- Police, fire & ambulance 911 emergency response

- Monitoring police officers' safety
- Monitoring contaminated well water
- Natural Resource Management
- Search and Rescue operations
- Hazardous waste management

Better accuracy and integrity of GPS data is the key benefit to NDGPS. Once fully operational, NDGPS users can expect to have 1-3 meter real-time positioning capability. In Arizona, there is good news to report about the implementation of the NDGPS for our region. Four NDGPS stations scheduled for implementation in 2000 will provide differential GPS for portions of the State. The stations and their scheduled implementation is listed below:

Fenner, California—April 1  
Flagstaff, Arizona—April 15  
Kirtland, New Mexico—April 15  
Duchesne, Utah—September 1

Eleven other NDGPS stations are also scheduled for implementation in 2000.

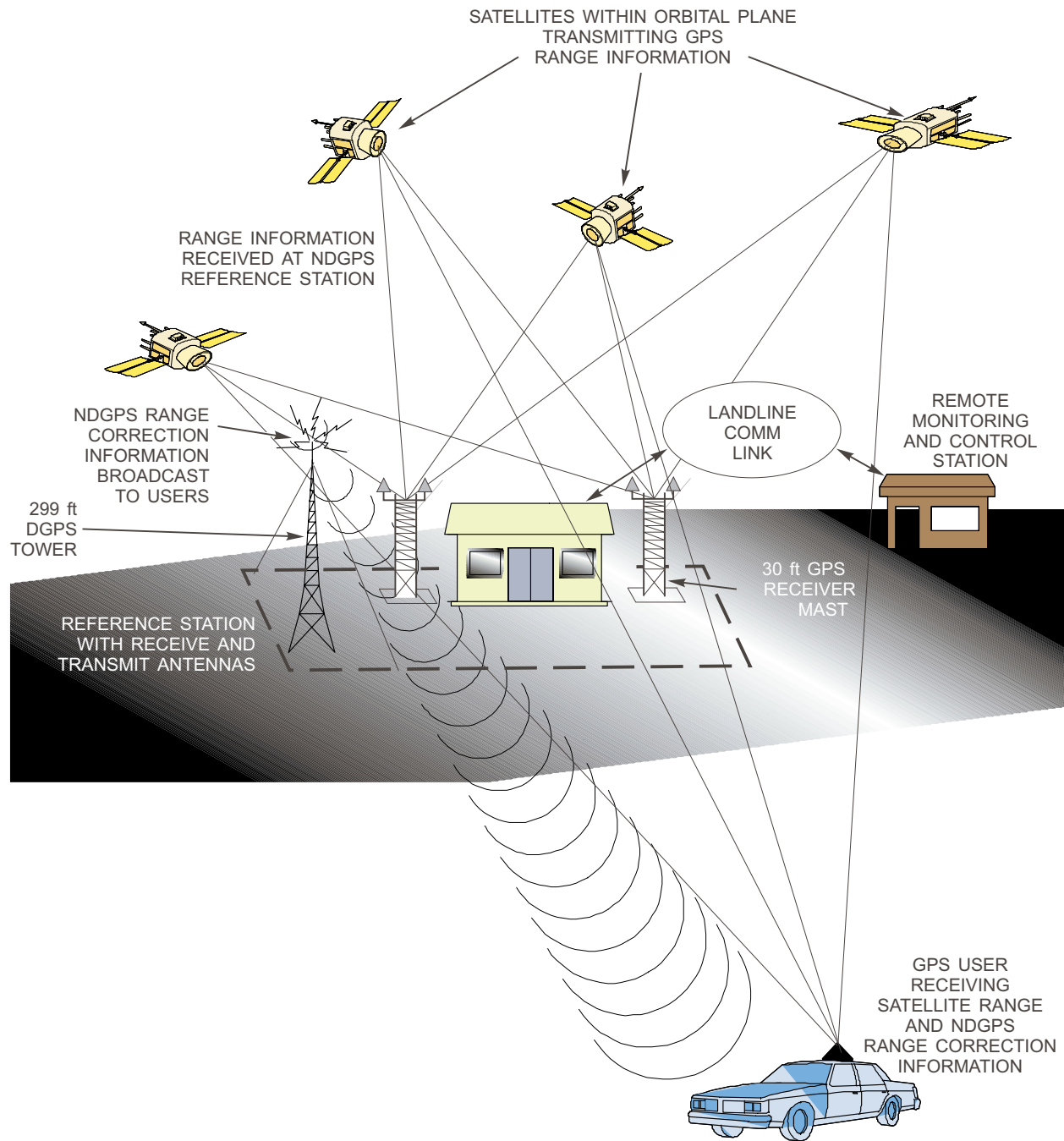
The Arizona Geographic Information Council (AGIC) and other states' councils passed resolutions to restore civilian GPS funding. This involves a lot of effort and support by all interested parties. If you would like to participate in the process to develop and restore civilian GPS contact Dave Minkel, Arizona NGS State Liaison or Gene Trobia, State Cartographer, at (602) 542-4060. ☎

### How does DGPS work?

*The GPS determined position of a reference station is computed and compared to its surveyed geodetic position. The differential information ... some systems use the error in fix position, while others use individual satellite range errors ... is transmitted to user receivers by radio or other means.*

	GPS Standard Positioning System	GPS Precise Positioning System (available only to US military)	Nationwide Differential GPS
<b>Accuracy</b> <i>*varies depending on equipment, distance from base station, and collection conditions</i>	100 meters	22 meters	1-3 meters real-time, 5 centimeters using post processing
<b>Availability</b>	99.87%	99.87%	99.999%





Source: Ronald L. Ketchum, John J. Lemmon, and J. Randy Hoffman, *Site Selection Plan and Installation Guidelines for a Nationwide Differential GPS Service*, Institute for Telecommunication Sciences, National Telecommunications and Information Administration, Boulder, Colorado, August 5, 1997.

Note: Modified by PB Farradyne and SRI International, September 1998.

DEPICTION OF GPS SATELLITE RANGE AND NDGPS CORRECTION SIGNAL BROADCASTS



Phone: 602-712-8958  
Fax: 602-256-7563  
Email: [jgarrison@dot.state.az.us](mailto:jgarrison@dot.state.az.us)

Arizona Department of Transportation  
Transportation Planning Group  
206 South 17th Avenue, #330B  
Phoenix, Arizona 85007-3213

#### ARIZONA TRANSPORTATION INFORMATION SYSTEM

### ATIS NEWS

ATIS News is published by the GIS Team of the Arizona Department of Transportation (ADOT), Transportation Planning Division to support and promote the use of GIS in ADOT. Our Staff members:

Tony Gonzales, GIS Project Leader  
Phone: (602) 712-7818  
email: [tgonzales@dot.state.az.us](mailto:tgonzales@dot.state.az.us)

Jami Garrison, Senior GIS Analyst  
Editor of ATIS News  
Phone: (602) 712-8958  
email: [jgarrison@dot.state.az.us](mailto:jgarrison@dot.state.az.us)

Wayne Rich, Senior GIS Analyst  
Phone: (602) 712-4837  
email: [wrich@dot.state.az.us](mailto:wrich@dot.state.az.us)

Walter 'Dutch' Duering, Planner  
Phone: (602) 712-8015  
email: [wduering@dot.state.az.us](mailto:wduering@dot.state.az.us)

If you are not currently on our mailing list and would like to be, contact Jami Garrison at the contact information listed below. Comments, questions or articles may also be submitted.

**ATIS Newsletter**  
**Arizona Dept of Transportation**  
206 South 17th Ave #330B  
Phoenix, AZ 85007  
(602) 712-8958  
[jgarrison@dot.state.az.us](mailto:jgarrison@dot.state.az.us)

### You're Invited! GIS User Group meeting

**Wednesday, January 19, 2000**  
**1:00 p.m.—3:00 p.m.**  
**ADOT Traffic Operations Center**  
**2302 W Durango Street, Phoenix**  
**Basement Conference Room**

*More Info:*  
*Contact Jami Garrison*  
*(602) 712-8958 or [jgarrison@dot.state.az.us](mailto:jgarrison@dot.state.az.us)*  
*Visit our website at <http://map.azfms.com/usergroup>*

